

# **TECHNOLOGY DEVELOPMENT FOR ENVIRONMENTAL MANAGEMENT**

## **MISSION AND PROGRESS**

Since November 1, 1989, the environmental mission of the U.S. Department of Energy (DOE) is to address and clean up the environmental legacy of the United States nuclear weapons program. This mission is large in scale, complex, and technically challenging. The enormity of the EM mission becomes apparent in several major tasks:

- Deactivating and/or decommissioning about 4,000 facilities that are no longer needed.
- Storing, treating, and disposing of radioactive and hazardous waste, including over 160,000 cubic meters that are currently in storage, and approximately 90 million gallons of high-level radioactive waste stored in tanks.
- Remediating 1.7 trillion gallons of contaminated groundwater and 40 million cubic meters of contaminated soil and debris.
- Providing long-term care and monitoring (or stewardship) for potentially hundreds of years at over 100 sites after cleanup.

Office of Environmental Management (EM) must accomplish the above tasks, and more, in a safe, efficient, environmentally sound, and defensible manner. The role of the EM Office of Science and Technology (OST) in accomplishing the EM mission is to provide the full range of science and technology resources and capabilities support. This support includes basic research and the development of innovative technology solutions from their conception through to their on-site demonstration and deployment. This support also includes providing the technical assistance needed to deliver and support fully developed, deployable scientific and technological solutions to site cleanup and long-term environmental stewardship problems.

Despite the size and complexity of its mission, EM has made substantial progress. At the start of FY 2000, EM had completed active cleanup at 69 of 113 sites. Although active cleanup is complete, many of these sites still require long-term care because wastes remain in place or long-term remedies, such as treating contaminated groundwater, are ongoing. DOE recently estimated that 109 of its sites would require some form of long-term stewardship.

## **THE EM ORGANIZATION: PAST AND PRESENT**

The management organization initially created to undertake environmental restoration and waste management was a centralized structure. As the environmental management program began to mature, a decentralized site-based organizational structure was adopted. Today, the EM cleanup program relies on a decentralized, site-oriented organizational structure to enhance management capabilities and streamline cleanup efforts. Under this management approach, the sites provide day-to-day management and direction of site cleanup efforts, whereas headquarters provides policy and guidance and champions site needs, issues, and funding.

The FY 2000 EM reorganization made the Office of Science and Technology (OST) the responsible organization for EM science and technology development and application, and added the responsibility for long-term site stewardship. In this capacity, OST provides a centralized science and technology organization to develop innovative technology solutions for the EM user community. As part of the reorganization, OST pursues the development of innovative technology solutions using a Focus Area centered approach. This approach focuses technology development on five major site cleanup problem areas.

The EM organization established November 21, 1999 is presented in the following subsections. The next subsection describes the first and second levels of the EM organization. The remaining subsections give

a brief description of the activities of the OST and its Focus Areas and Crosscutting Programs and their interactions with each other and the other EM organizations.

## **THE PRESENT EM ORGANIZATION**

The OST is one of five Deputy Assistant Secretarial Offices within EM; a brief description of each is presented in the following organization breakout. The Characterization, Monitoring, and Sensor Technology Crosscutting Program (CMST-CP) is one of the applied research components of OST; it works with the OST Focus Areas and is managed by the Nevada Operations Office. The current EM organizational structure is shown on page 3.

### **Office of the Assistant Secretary for Environmental Management (EM-1)**

The Assistant Secretary for Environmental Management (EM-1) is the highest-level executive within EM. EM-1 is nominated by the President and confirmed by the U.S. Senate, and provides executive level policy, direction, and guidance for site cleanup efforts as well as for the EM science and technology program. The Deputy Assistant Secretaries assist EM-1 in providing policy and guidance to the sites.

### **Office of Policy, Planning, and Budget (EM-10)**

This Office serves as the principal budget and administrative office for the EM program.

### **Office of Integration and Disposition (EM-20)**

This Office provides policy and national perspective on crosscutting and integration efforts among the sites. It also champions the Waste Isolation Pilot Plant, which is managed by the Carlsbad Area Office.

### **Office of Site Closure (EM-30)**

This Office provides policy and guidance and champions the Closure Sites. Closure Sites include the Ohio, Oak Ridge, Rocky Flats, and other smaller cleanup sites; these sites are accelerating their activities in order to achieve site closure on a relatively short schedule.

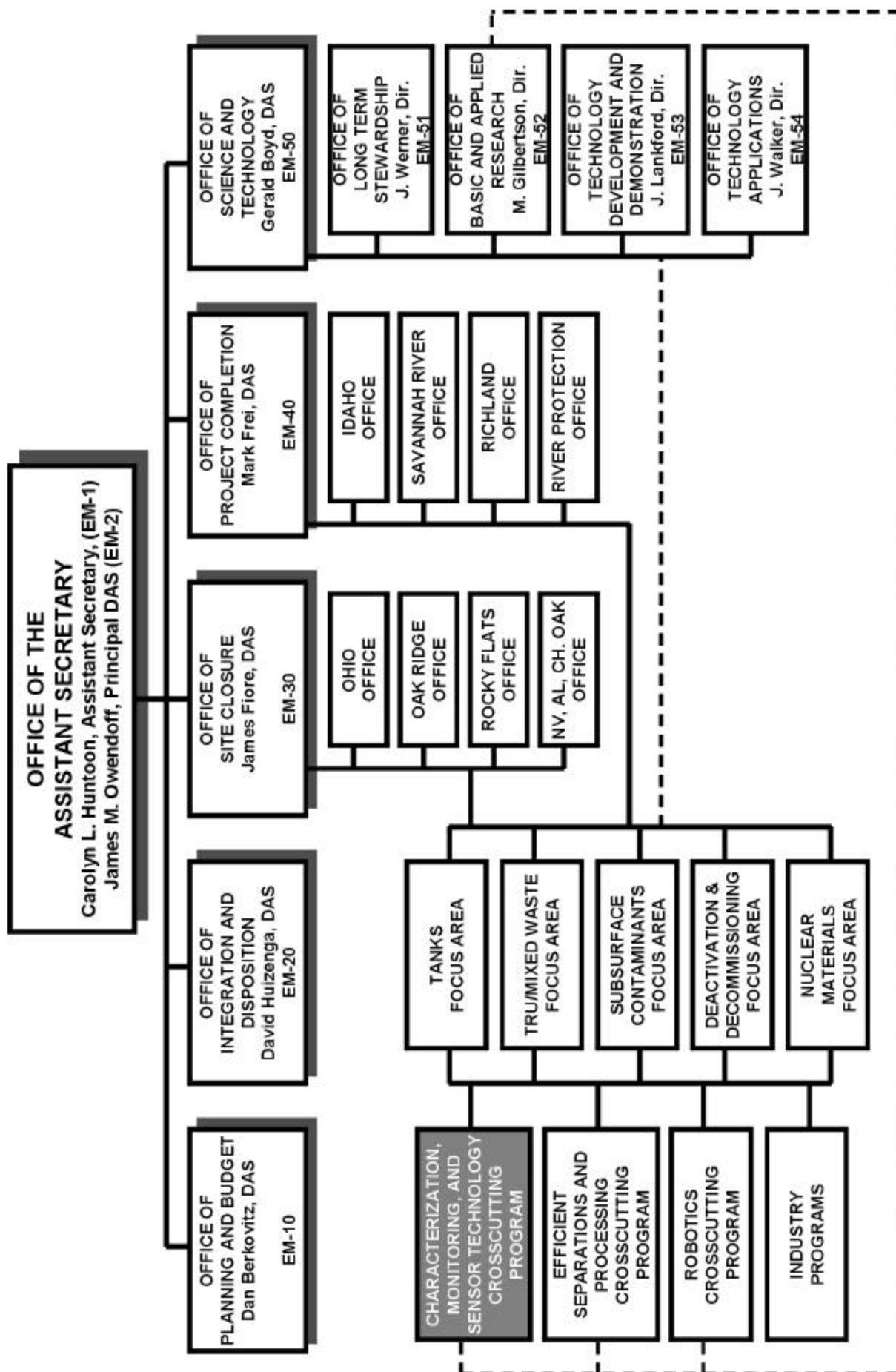
### **Office of Project Completion (EM-40)**

This Office provides policy and guidance and champions the Project Completion Sites. Project Completion Sites include the Savannah River, Idaho, Richland, and Office of River Protection sites; these sites have longer-term cleanup schedules consistent with their more complex natures, which include high-level radioactive waste cleanup.

### **Office of Science and Technology (EM-50)**

This Office manages solutions-oriented science and technology development programs to reduce waste management life-cycle costs and risks to people and the environment. OST programs involve basic science, applied research and development and demonstration, testing, and evaluation of innovative technologies and technology systems.

# OFFICE OF ENVIRONMENTAL MANAGEMENT



## **OFFICE OF SCIENCE AND TECHNOLOGY (OST) ACTIVITIES**

OST programs establish, direct, and manage targeted research ranging from broad fundamental research with potentially wide-ranging applications to fine-tuned, needs-driven, applied technology development. OST provides technology solutions that address major needs of its EM customers through integration of basic and applied research and development conducted by Focus Areas and Crosscutting Programs, including Industry Programs. OST strives to involve private sector technology providers and commercial users in developing and improving technologies that address site needs, and works with interested parties, stakeholders, and public interest groups in assessing the acceptability, availability, and use of improved technical solutions. OST programs provide uniform guidance, facilitate technology transfer, and ensure that stakeholder needs are integrated into the decision-making process.

OST includes four Headquarters-based offices:

### **Office of Long Term Stewardship (EM-51)**

This newly created Office addresses issues associated with long-term care and protection of human health and the environment at DOE sites and facilities after cleanup activities have been completed. Many DOE sites cannot be remediated to a state allowing unrestricted use. Goals of the Office of Long Term Stewardship (LTS) include planning for responsible handling of such properties following cleanup efforts, encouraging sites to integrate LTS considerations into their selection of remediation alternatives, and exploring the many political, societal, and economic issues that such sites pose.

### **Office of Basic and Applied Research (EM-52)**

This Office was originally designed to focus the national scientific infrastructure on critical national environmental management problems. Its major purpose now is to manage the EM Science Program and applied research. Its mission includes development of a targeted, long-term basic research agenda for environmental problems so that breakthrough ("step-change") approaches can lead to significant reductions in the costs and risks associated with the EM program. The Office of Basic and Applied Research also bridges the gap between broad fundamental research, such as that performed by the DOE Office of Energy Research, and the needs-driven applied technology development conducted by the OST.

### **Office of Technology Development and Demonstration (EM-53)**

The Office of Technology Development and Demonstration is responsible for establishing, managing, and directing the targeted development and demonstration phases of Environmental Management's (EM's) Office of Science and Technology (OST) programs. The Office of Technology Development and Demonstration will identify the best available applied research and transition these activities into an effective technology development program. The overall goal of the office is to deliver fully developed and demonstrated for site use. Developed and demonstrated products will be advanced, strongly aligned with end-user needs, fully documented, assured of supplier-availability, readily deployable, acceptable to regulators and stakeholders and ready when needed.

### **Office of Technology Applications (EM-54)**

This Office addresses issues that affect the involvement of critical external entities such as production and waste sites, users, the public, governmental entities, tribes, regulators, and commercial parties. It is involved in the assessment, acceptability, availability, and use of improved technical solutions by providing uniform guidance, tools, and initiatives to support OST. The Office of Technology Applications sponsors efforts to encourage and promote the involvement of affected parties in regulatory issues. It also sponsors domestic and international technology transfer activities and coordinates planning and cost-benefit analyses with other EM organizations. A major activity added to this Office's responsibilities is that of providing deployment assistance to users.

## **FOCUS AREA ACTIVITIES**

The Focus Areas interact directly with the DOE sites and are supported by the Crosscutting Programs. The five current Focus Areas are:

### **Tanks Focus Area (TFA)**

TFA provides new or improved technologies to safely and efficiently remediate 289 underground storage tanks that have been used to process and store approximately 90 million gallons of high-level radioactive and hazardous chemical mixed waste. Technologies are needed to characterize, retrieve, and treat the waste before radioactive components are immobilized. All this must be done in a safe working environment. Emphasis is placed on *in situ* and remotely handled processes and waste volume minimization. Research and development of technologies in this area are aimed at enabling tank farm closure using safe and cost-efficient solutions that are acceptable to the public and fulfill the requirements of site regulatory agreements under the Federal Facility Compliance Act.

### **Subsurface Contaminants Focus Area (SCFA)**

SCFA provides new or improved technologies to address environmental problems associated with hazardous and radioactive contaminants in soil and groundwater. Over 1.7 trillion gallons of groundwater and 40 million cubic meters of soil are contaminated at more than 5,700 locations on DOE sites. The contaminants include radionuclides, heavy metals, and hazardous organic compounds. Migration of certain contaminants threatens water resources; in some cases it has already had an adverse effect on off-site locations. Emphasis is placed on the development of *in situ* technologies to minimize remediation costs and potential worker exposures as well as to implement effective and reliable contaminant migration barriers.

### **Transuranics/Mixed Waste Focus Area (TMFA)**

The scope of the MWFA was recently expanded to include transuranic (TRU) wastes and transuranics was added to its name. The TMFA provides new or improved characterization and treatment systems for mixed radioactive and hazardous chemical waste as well as processes for the disposal of low-level mixed waste and transuranic waste in a manner that meets regulatory requirements. There are over 167,000 cubic meters of mixed wastes from over 1,400 waste streams at 38 DOE sites. Emphasis is placed on developing cost-effective characterization and monitoring systems, waste volume reduction, and safe permanent disposal methods and strategies.

### **Nuclear Materials Focus Area (NMFA)**

The NMFA provides new or improved technologies for safe and effective long-term storage of nuclear materials. These technologies involve handling and disposing of impure plutonium oxides, interim storage of stabilized plutonium residues pending disposition to the Waste Isolation Pilot Plant (WIPP), and safety surveillance for long-term plutonium and other long-lived nuclear material storage.

### **Deactivation and Decommissioning Focus Area (DDFA)**

DDFA provides new or improved technologies to deactivate 7,000 contaminated buildings and decommission 700 buildings. This includes decontaminating metal and concrete within those buildings and disposing of over 180,000 metric tons of scrap metal. This Focus Area emphasizes large-scale demonstrations, each of which incorporates improved technologies identified as responsive to high-priority needs. Such demonstrations also include existing commercial technologies to provide bases for comparisons of cost and effectiveness.

## **CROSCUTTING PROGRAM ACTIVITIES**

The Crosscutting Programs interact directly with the Focus Areas in addressing site technology needs. The Crosscutting Programs assess existing technologies and methodologies and, where no adequate technology currently exists, develop innovative technology solutions to site needs that are common to more than one Focus Area. The Crosscutting Programs are:

### **Characterization, Monitoring, and Sensor Technology (CMST-CP)**

The CMST-CP identifies, develops, and improves sensors, monitors, and site and waste characterization technologies to enhance worker safety, lower costs, and enable efficient operations during site cleanup and remediation, waste treatment and disposal, and facility deactivation and decontamination.

### **Efficient Separations and Processing Crosscutting Program (ESP-CP)**

The ESP-CP develops waste separation and treatment processes and evaluates existing technologies to separate and treat waste components for disposal.

### **Robotics Technology Development Crosscutting Program (RBX-CP)**

The RBX-CP develops robotic systems to minimize worker exposure while providing proven, cost-effective and, in some cases unique, approaches to problems.

### **Industry Programs (IP)**

IP, centered at the DOE National Energy Technology Laboratory (NETL), assists the Focus Areas and other Crosscutting Programs by issuing Requests for Proposals to industry and university researchers and coordinating the resulting research projects. The IP mission is to foster private sector businesses to develop, demonstrate, and deploy cost-effective technologies that will be used to solve problems at multiple DOE sites.

***An Overview of the Characterization, Monitoring, and Sensor Technology Crosscutting Program is provided in the next section of this document.***